HUMPBACK WHALE SONGS ALONG THE COAST OF WESTERN AUSTRALIA AND SOME COMPARISON WITH EAST COAST SONGS

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Humpback Whale songs have been recorded since 1986 off Western Australia. These songs share no themes with those recorded off eastern Australia, supporting other evidence that the two breeding stocks are separate despite some overlap in Antarctic feeding areas.

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Humpback whales regularly migrate along continental coastlines in the Southern Hemisphere (Dawbin, 1966), and produce complex songs (Payne and McVay, 1971) which change over time (Payne et al., 1983). To date most detailed studies refer to Northern Hemisphere stocks. This report describes the results of studies from the west coast of Australia which began in 1986, together with comparison with data collected from the east coast in 1989

Studies of populations of humpbacks in the Northern Hemisphere have shown that songs are similar within oceans, but differ significantly where oceans are isolated by a land mass (Payne and Guinee, 1983 ; Winn et al., 1981). The Australian populations of Areas IV and V also exhibit major differences from each other in song length and content.

Evolution of songs can be a gradual or rapid process, with songs changing not only from year to year, but also within the year, as the whales migrate to and from the breeding grounds.

This paper will examine some of the song changes that have occurred amongst the Area IV population during 1986–1989, with recent data from 1990 included. Recordings from the east coast will be examined briefly for comparison between populations.

METHODS

Equipment used was a Clevite Ordnance Oyster hydrophone (CH-15) with 30 m of cable, a preamplifier and a Sony WMD6 cassette recorder. Recordings used for analysis were made during the migration period from Dampier (20° 39'S, 116° 45'E) to Rottnest Island (32° 00'S, 115° 30'E). Other recordings have been made along the west coast from its northern most to southern most extremities (Dawbin and Gill, this memoir). Spectrograms of the songs and short hand use of descriptive words for each sound were incorporated for song analysis. The spectrograms were traced for the purposes of this report to eliminate background noise and enable clearer definition of song units.

Themes were numbered by allocating the last theme as that which included sounds which were nearest in character to the "surface ratchet" described by Winn et al. (1971). As songs may differ between singers, comparisons here are made on what are regarded as representative song samples.

Table 1, demonstrating song change, uses methods as described by Helweg et al. (1990). The Western Australian 1986 song is used as a reference, with each theme occurring after the surface ratchet labelled successively from A to E. Themes from following years which correspond to any of those in 1986 fall into A to E, but new themes are given subsequent new letters.

RESULTS

The song changed in the first theme from 1986 to 1988 and 1990 (Fig. 1). Between the 1986 and 1987 songs there was substantial change, with little similarity between themes. In 1988 there was substantial change from the 1987 song repertoire. From 1988 onwards, however, the arrangements of sounds within themes became more similar, with only slight progressive change between units of sound from 1988 to 1990.

The change in song from 1986 to 1987 was not as great as it was from 1987 to 1988 (Table 1). The number of themes remained the same over

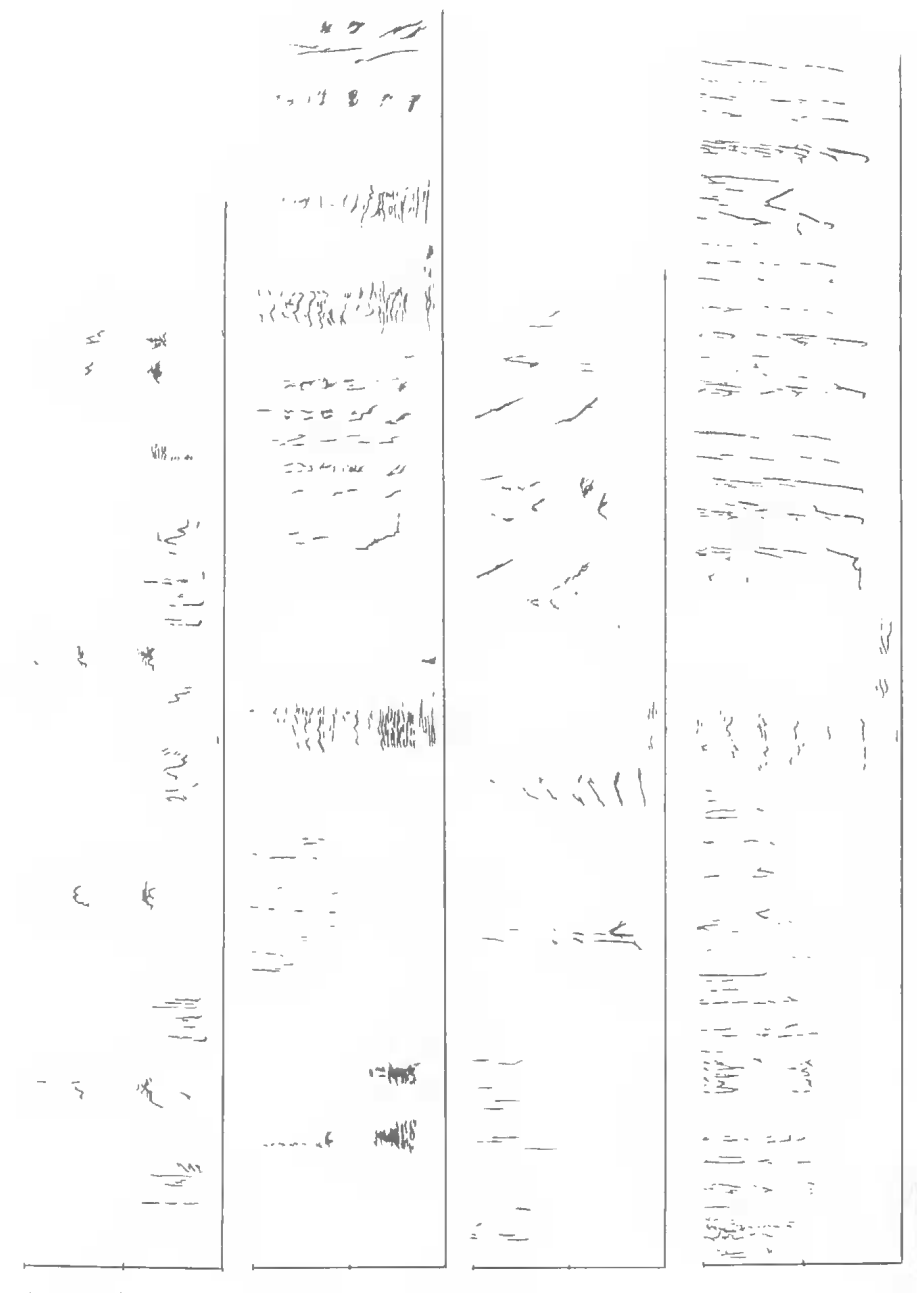

FIG. 1. Comparison of the first theme along the west coast of Australia from 1986 to 1988 and 1990, using tracings of spectrograms to illustrate the changes that have occurred.

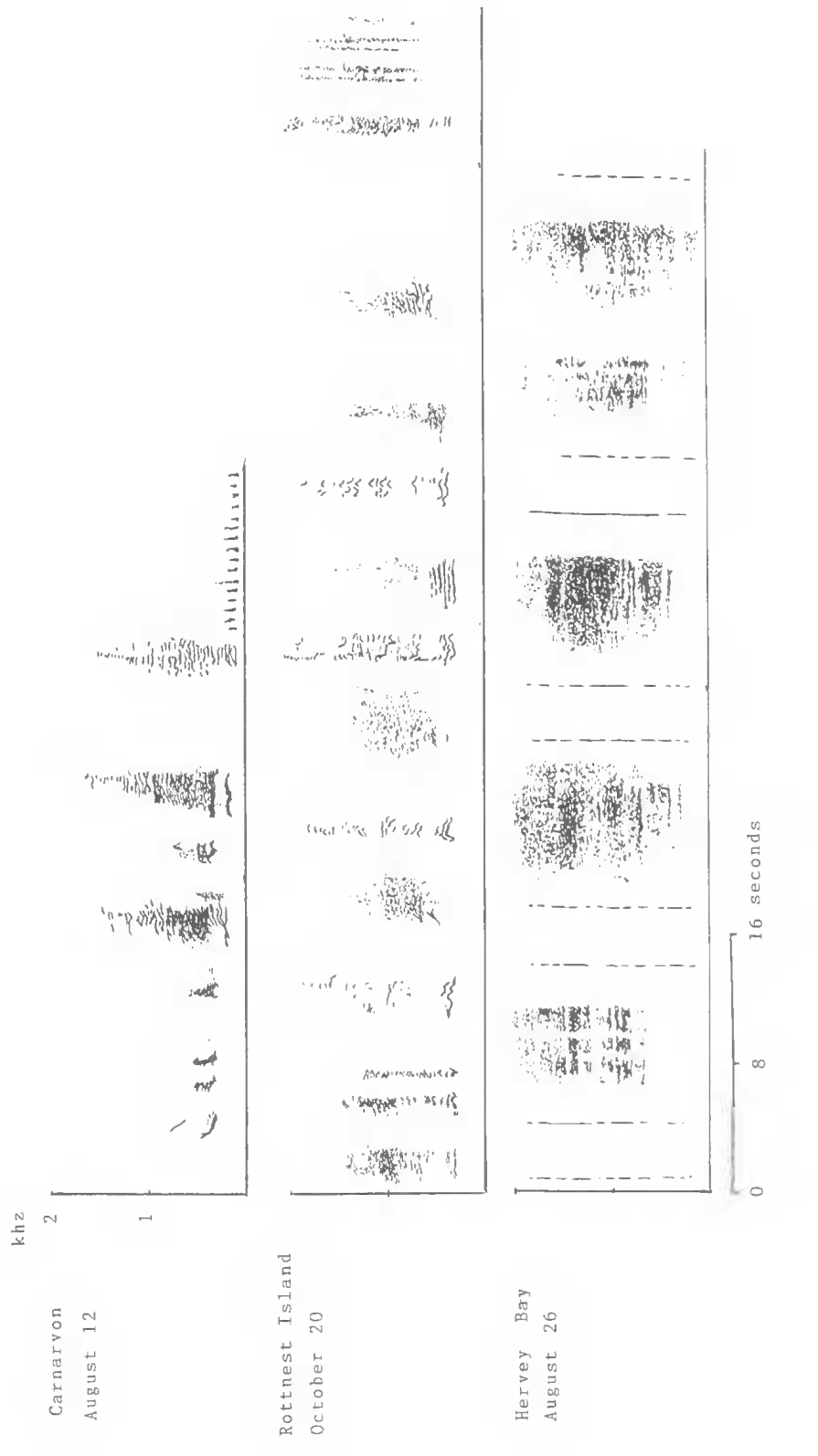

FIG. 2. Spectrogram tracings comparing a representative phrase of the last theme from different recordings during 1989. The first two samples illustrate northern and southern migration song, respectively, along Western Australia. The second sample shows more repetitions of sound units than the first, resulting in a longer phrase. The third tracing is from the east coast and demonstrates a difference in the content of the last theme between each coast. The time scale is approximate.

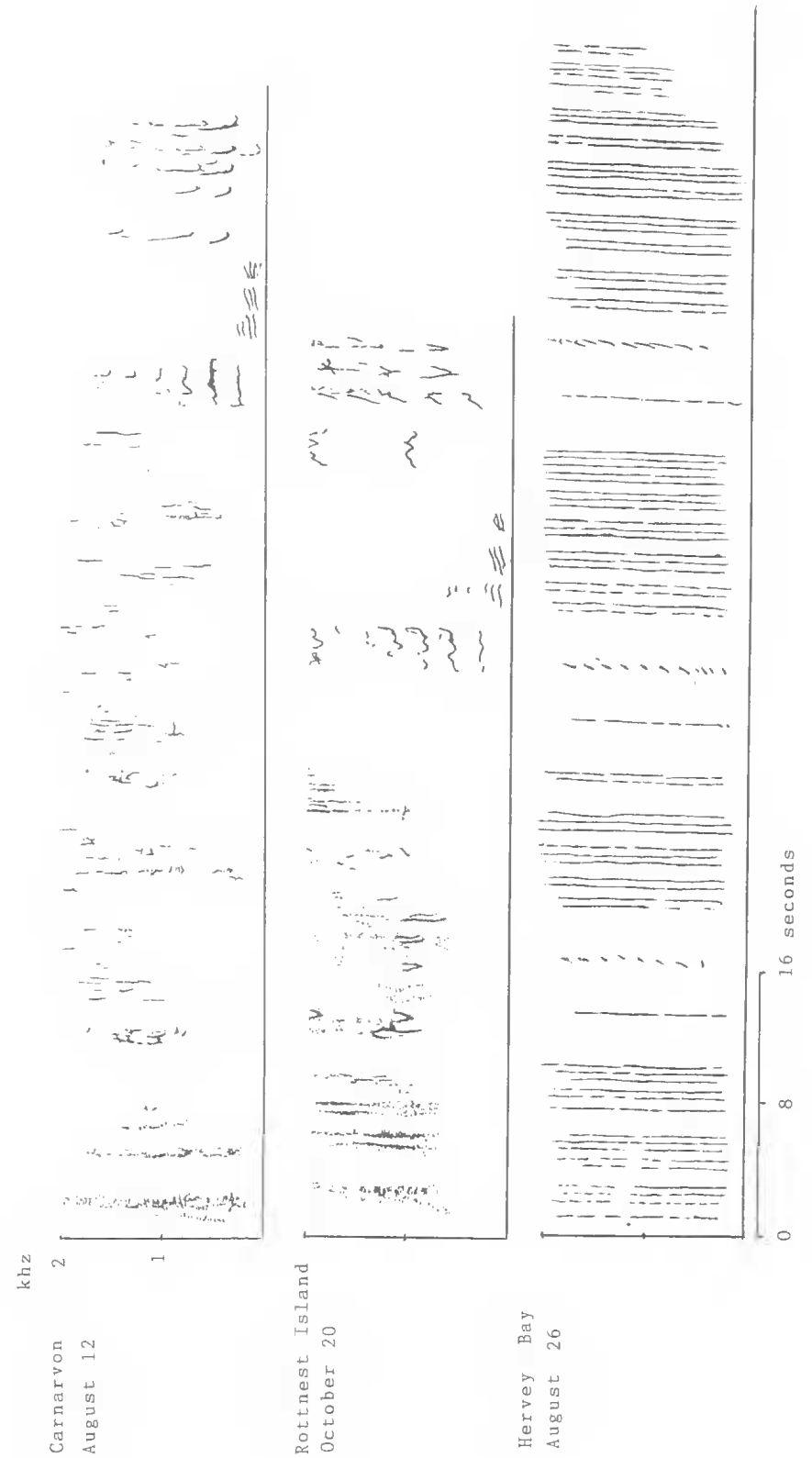

FIG. 3. Spectrogram tracings comparing a representative phrase of the first theme from different recordings during 1989 for the same data as Fig. 2. Again, the West coast samples show different numbers of repetitions of sound units, and thus different phrase durations.

1986 and 1987 and then decreased from 5 to 4 in 1988 (Table 1). The song remained stable during 1988 and 1989, and then in 1990 two themes were incorporated into one, dropping the theme number from 4 to 3.

For further comparison, Fig. 2 shows the last theme from the year 1989, and Fig. 3 the first theme from the same year. Both northern and southern migration songs are represented from Western Australia and these resemble each other. These first and last themes of 1989 resemble the first and last themes of 1988 and 1990 (Fig. 1).

THEME	WA86	WA87	WA88	WA89	WA90	HB89
A	*					
B	*					
C	*					
D	*					
E	*	*				
F		*				
G		*				
H		*				
I		*				
J			*	*	*	
K			*	*	*	
L			*	*	*	
M			*	*	*	
N						*
O						*
P						*
Q						*

TABLE 1. Repeated and new themes over five years on the west coast and a comparison with one year from the east coast of Australia. The 1990 song consists of three themes, but the first theme is actually an incorporation of the first and second theme from 1988 and 1989.

The east and west coast show no similarity in song content. The 1989 Hervey Bay sample has no shared themes with the west from any years (Table 1). There is no similarity between coasts in song elements in the first and last themes during 1989 (Figs 2,3). This contrasts with the sharing of at least some themes between Hawaii, Mexico and Bonin Islands (Helweg et al., 1990). Evidence from "Discovery" marks indicates that two animals marked off eastern Australia were killed off Western Australia (Chittleborough, 1965) but acoustic data from the present study suggest a high degree of independence between east and west coast breeding stocks.

DISCUSSION

Song change can occur on many levels. Recordings from both coasts of Australia have shown that the content and structure of a song may change between years or within years during the northern and southern migrations. There can also be differences between individual singers and each song rendition of an individual. Change can occur either suddenly or progressively, and even within the songs themselves there can be different rates of evolution.

Recordings from east and west show that little or progressive change tends to occur in the last and first theme, and that the majority of change occurs in the 'body' of the song. Therefore gradual change is more likely to happen at the end or beginning, with more rapid change taking place in the middle. This rapid change was seen in the middle themes from 1986 and 1987, with the first and last themes evolving at a slower rate. In contrast, a slower change from 1988 to 1990 occurred during the whole song, with some themes not changing at all.

Recordings were made during migration as opposed to on the breeding grounds. This is a difficult environment to record in, as the whales are in transit on active migration, and weather conditions are more frequently unfavourable. This enabled only a small sample of song to be collected each year, and the identification and subsequent resighting of individual singers was virtually impossible.

Our studies have shown, however, that Australian Humpback Whale song differs between the west and east coast and that these songs change over time. The variability in song and the different rates it can occur at have been presented here, but what determines the rate of change remains unknown.

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